

(column 3, lines 19-21), the second part is the bistream information stream, and the third part is the bitstream information trailer (column 3, lines 25-41).

The bitstream information stream includes a PACKET\_LOST flag to indicate when a packet is lost (column 3, lines 26-28). The bitstream information stream also has data that identifies which of the video frame data are lost and indicate parameters for decompressing the compressed bitstream. (Abstract) Replacement compressed bitstream data is placed in the compressed bitstream in place of video frame data in the lost packet so that uncompressed video image data can be generated based on the data in the bitstream information stream. (Abstract)

The bitstream information trailer includes: a SrcVersion, specifying the source of the extension (column 3, lines 52-53); a CompressedSize, indicating the compressed byte size of the bitstream; a NumberOfPackets, specifying the total number of packets for the frame; H.263 specific flags; and various format specific fields such as a SourceFormat field, and Quarter Common Intermediate Format Field (column 3, line 51- column 4, line 6).

The independent claims of the present application recite information “specifying network packet boundaries” allowing an apparatus to “rapidly divide the bitstream into network packets for real-time streaming.” Zhu does not teach or suggest annotating the bitstream with information “specifying network packet boundaries.” Neither the standard bitstream, the bitstream information, nor the bitstream information trailer provide information “specifying network packet boundaries.” The network packet boundaries allow a streaming apparatus to “rapidly divide the bitstream into network packets for real-time streaming.” Zhu does not describe rapidly dividing a bitstream and instead focuses on error correction.

One could argue that the specification states that the bitstream information stream is used to “build packets for transmission,” (column 4, lines 12-14). However, Zhu does not describe how the bitstream information stream is used divide bitstream to build packets for transmission. Zhu does not disclose any mechanisms for annotating the bistream with information “specifying the network packet boundaries.” Zhu only describes bitstream information useful for building packet headers or implementing error correction. For building packet headers, “the payload handler 37 uses the information from the bitstream information stream 42 to fill in data for the H.263 payload header 72. (column 4, lines 38-40). For implementing error correction, “the

codec 36 need not look to the bitstream information stream or the bitstream information trailer unless it encounters a bit pattern indicating that a packet has been lost in the standard compressed bitstream in the process of a normal decoding operation” (column 6, lines 5-7). If an error is found, “the bitstream information stream and bistream information trailer are accessed to obtain the proper motion vectors, quantization parameters, etc. so that the lost macroblock can be intelligently recreated” (column 6, lines 20-25).

In fact, Zhu is believed to merely add error correction capabilities to a system that uses a conventional mechanism for splitting a bitstream. Zhu’s conventional packet splitting mechanism does not “rapidly divide the bitstream into network packets for real-time streaming.” The techniques of the present invention recognize the drawbacks of splitting a bitstream using a conventional mechanism. From the Background of the present application (page 4, line 19 – page 5, line 5), “there are several problems commonly encountered when repacketizing MPEG data into RTP packets. First, the server 103 must parse the entire MPEG bitstream, bit by bit, in order to determine how it will carve the MPEG system stream. More specifically, it must parse the entire MPEG bitstream to apply the protocol rules to locate appropriate start and end points for each RTP packet. In addition, the server must gather information to create the RTP packet headers. This parsing and information gathering imposes substantial processing load on the server CPU and may limit the ability of the server 103 to deliver real-time multimedia.”

“The second problem arises because two copy operations are required to parse the bitstream. The first copy operation transfers the MPEG data from the file 102 into the buffer 108 where it is parsed. The second copy operation moves the data from the buffer 108 into the network packets. These two copy operations require significant CPU processing load, which again may limit the ability of the server 103 to deliver real-time multimedia.”

Consequently, the independent claims of the present application recite information “specifying network packet boundaries” allowing an apparatus to “rapidly divide the bitstream into network packets for real-time streaming.” Such information provides many benefits over conventional mechanisms.

In view of the foregoing, Applicants believe all independent and dependent claims now pending in this application are in condition for allowance. If the Examiner believes a telephone

conference would expedite prosecution of this application, please telephone the undersigned at (510) 843-6200.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Godfrey K. Kwan', with a long horizontal flourish extending to the right.

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## **Appendix A - Pending Claims**

1. A method of preparing a compressed audio, video, or multimedia bitstream to facilitate real time streaming of the bitstream, the method comprising:  
parsing the bitstream to identify network packet boundaries in the bitstream; and  
annotating the bitstream with network packet information specifying the network packet boundaries such that a streaming apparatus can use the network packet information to rapidly divide the bitstream into network packets for real-time streaming.
2. The method of claim 1 wherein the network packet information includes an index specifying a byte position in the bitstream, the byte position identifies the first bitstream byte to be included in a network packet.
3. The method of claim 2 wherein the index is included in a group of pictures header and the index includes starting and ending byte locations for MPEG packets included in a group of pictures associated with the group of pictures header.
4. The method of claim 2 further including separating the bitstream into an elementary audio stream and a elementary video stream.
5. The method of claim 4 further including inserting the index in one of the elementary audio stream and the elementary video stream.
6. The method of claim 5 wherein the index is inserted into the elementary video stream.
7. The method of claim 1 wherein the network packet information includes a length specifying how many bits from the bitstream are to be included in a network packet.
8. The method of claim 1 wherein the network packet information includes a type designation specifying the type of data from the bitstream that is to be included in a network packet.

9. The method of claim 1 wherein the network packet information includes an index specifying a byte position in the bitstream, the byte position identifies the first bitstream byte to be included in a network packet, a length specifying how many bytes from the bitstream are to be included in a network packet and a type designation specifying the type of data from the bitstream that is to be included in a network packet.
10. The method of claim 1 wherein the bitstream includes both audio and video data and wherein the network packet information specifies network packet boundaries for packets containing audio data and for packets containing video data.
11. The method of claim 10 further comprising combining an annotated video bitstream with an annotated audio bitstream to create a modified system stream.
12. The method of claim 11 wherein the modified system stream is an MPEG bitstream.
13. The method of claim 12 wherein the beginning of a network boundary is located according to start code included in the MPEG bitstream.
14. The method of claim 13 wherein the start code is one of a sequence header, a group of pictures header and a picture header.
15. The method of claim 1 wherein the network packet information includes network packet header information.
16. The method of claim 1 wherein the network packet boundaries are variably sized according to a network protocol.
17. The method of claim 1 wherein the network packet boundaries are a constant sized.
18. The method of claim 1 further including adding a flag to the bitstream which signals that the bitstream is annotated.

19. A computer program product comprising a machine readable medium on which is provided instructions for preparing a compressed audio, video, or multimedia bitstream to facilitate real-time streaming of the bitstream, the instructions comprising:
- parsing the bitstream to identify network packet boundaries in the bitstream; and
  - annotating the bitstream with network packet information specifying the network packet boundaries such that a streaming apparatus can use the network packet information and rapidly divide the bitstream into network packets for real-time streaming.
20. The computer program product of claim 19 wherein the network packet information includes an index specifying a byte position in the bitstream, the byte position identifies the first bitstream byte to be included in a network packet, a length specifying how many bytes from the bitstream are to be included in a network packet and a type designation specifying the type of data from the bitstream that is to be included in a network packet.
21. The computer program product of claim 20 wherein the bitstream is an MPEG bitstream.
22. The computer program product of claim 21 wherein the index is appended onto a group of pictures header.
23. The computer program product of claim 19 wherein the bitstream includes both audio and video data and wherein the network packet information specifies network packet boundaries for packets containing audio data and for packets containing video data.
24. A method of performing real-time streaming of a bitstream, the method comprising:
- parsing the bitstream to identify network packet boundaries in the bitstream;
  - annotating the bitstream with network packet information specifying the network packet boundaries;
  - storing the annotated bitstream; and
  - block streaming the bitstream in real-time using the network packet information to divide the bitstream into network packets.
25. The method of claim 24 further including block copying data from the annotated bitstream into an RTP bitstream.

26. The method of claim 24 further including demultiplexing the bitstream.
27. The method of claim 24 wherein the bitstream includes an elementary video stream and an elementary audio stream.
28. The method of claim 27 wherein the bitstream is annotated with network packet information such that an integer number of audio frames in the elementary audio stream are included in each of the network packet boundaries.
29. A system for transmitting a compressed audio, video, or multimedia bitstream, the system comprising:  
a demultiplexer;  
a segmentor capable of annotating the bitstream with network packet information specifying network packet boundaries;  
a multiplexer; and  
a streaming apparatus that uses the network packet information to divide the bitstream into network packets for real-time streaming.
30. The system of claim 29 wherein the segmentor produces one of an annotated video stream or an annotated audio stream containing the network packet information.
31. The system of claim 29 wherein the demultiplexer produces an audio stream and a video stream.
32. The system of claim 31 further including one or more buffers that store the audio stream and the video stream.
33. The system of claim 31 further including a second demultiplexer.
34. The system of claim 29 wherein the multiplexer produces a modified bitstream including the network packet information specifying network packet boundaries.

35. The system of claim 34 further including a memory that stores the modified bitstream.

36. The system of claim 29 wherein the streaming apparatus uses a single block copy for a network packet for real-time streaming.

37. A system for transmitting a compressed audio, video, or multimedia bitstream, the system comprising:

- a demultiplexer for separating a system stream into an audio stream and a video stream;
- a segmentor for annotating the video stream with network packet information specifying network packet boundaries;

- a multiplexer for combining the audio and video streams into a modified system stream;

and

- a streaming apparatus for dividing the modified system bitstream into network packets for real-time streaming using the network packet information.

38. A system for transmitting a compressed audio, video, or multimedia bitstream, the system comprising:

- means for separating a system stream into an audio stream and a video stream;

- means for annotating the video stream with network packet information specifying network packet boundaries;

- means for combining the audio and video streams into a modified system stream; and

- means for dividing the modified system bitstream into network packets for real-time streaming using the network packet information.